On each of the ATM switches 520 and 530, a port exists which is connected to an individual IP router 525 and 535, respectively. Note that this assumption does not require that there be a physical link to an IP router on each and every ATM switch, only that there is a port on every switch that has access to an IP router. In such a case when there an IP router is not physically connected to every switch, some minimal coordination is needed between the ATM switches to establish a default route.

When the ATM switches are initially setup, and as shown pictorially in FIG. 5(a), all unknown VCs in a VP/VC routing table are routed to the port of the switch that has access to the IP router. Consequently, when a connectionless IP packet arrives at the Source node, the Source node will pick an available VC from its pool and send it forward to the first ATM switch. Since the VC picked by the Source Node is unknown to the first ATM switch, this first ATM Switch will direct the connectionless IP packet received to the IP router it is connected to, for IP level processing (routed mode).

While the packet is being processed by the IP router to determine its next hop, any successive ATM cells associated with that packet are stored in a buffer particular to that VC. After a next hop is determined (in this case 524), the stored cells are redirected to an actual port with a new VC picked for link 524 by the first ATM Switch. [Col. 7, lines 16-41]

FIG. 8 shows a multicast scenario between a SRC 800 and multiple RCVs' 820, 830, 840 each connected to an ATM switch in the ATM network 810, with each switch, in turn having access to an IP router. With such an implementation, control messages (PRUNE, GRAFT, JOIN, etc) are sent on a routed path, while data transmitted between the SRC and each of the RCV nodes is sent over a switched path. Advantageously, this method preserves the scaling and dynamic flow properties of IP multicast protocols while exhibiting simple, direct mapping of IP multicast semantics (Sender, Group) to underlying ATM switch hardware.
Inter-router/inter switch forwarding
Inter-router/inter switch forwarding is accomplished with our method utilizing the same basic infrastructure as before where all default VCs point to a nearest IP router. This involves an IP overlay network situated on top of the ATM and is created by next-hop IP routers in communication with one another. The packets that travel on this IP network are in the routed path (default path), any remaining packets go through the switched path and do not

involve IP processing.
DVMRP operates by sending the first data packets on a broadcast tree rooted at the source. That tree is dynamically created. If a packet arrives on the shortest reverse path to the source, it is forwarded to all outgoing links. If the router receives a prune(source,group) message from a downstream router, it sets a don't-forward (source, group, link) flag for the (S, G) entry. This is a timer-based flag so once the timer expires, the don't-forward becomes forward (soft-state with negative refreshes).
IPSOFACTO Implementation of DVMRP protocol
The IPSOFACTO implementation of the DVMRP protocol in shown in FIG. 9. Specifically, a new cell is received by a node 900, a determination is made whether a VC exists to transport that cell 902. If so, the cell is transported via a switched mode 904. Alternatively, when no VC exists, a packet is assembled 906. Subsequently, a 1-2 bcast bitmap is created and the packet is forwarded to a next node 908. When a PRUNE message 911 is received which specifies a multicast group 910, a bit contained within a bitmap is cleared 912. Such PRUNING may continue until every bit in the bitmap is cleared. When all of the bits are cleared and the bitmap is empty 914, the VC is torn down 916 and the entire process may continue again. Conversely, when a JOIN message 913 is received which specifies the multicast group, a bit contained within the bitmap is set 915.
Any prune/forward messages travel on an overlay IP network (routed path). For downstream routers that do not prune, the upstream router picks up an unused VP/VC and forwards the datagram to the downstream router. The source-specific multicast flow is then switched if it is not pruned. [Col. 14, line 46 - Col. 15, line 29]

When a packet arrives at the router, it creates a shortest path tree rooted at the source whose leaves are multicast members. If the router is a node on the tree and the packet received on the reverse path then it either forwards it or drops it. The tree computation is done for the first packet and the entry is cached until a new link state update is received or no traffic traverses that path for a finite time. [Col. 16, lines 21-27]

These portions of Acharya neither disclose nor suggest "multicasting data to at least one line card ...; and storing state information associated with the data as a default state at each line card the data was multicast to."

Claim 2 further distinguishes over Acharya by reciting that "the state information includes a source parameter indicating a source of the data." Even if Acharya describes a source address associated with Frame Relay packets (Col. 10, lines 42-49), Acharya does not disclose a source parameter included in state information associated with the data <u>that was multicast to at least one line card</u> indicating a source of the data.

Claim 3 further distinguishes over Acharya by reciting that "the state information includes a group parameter indicating at least one destination of the data." Even if Acharya describes a destination address associated with Frame Relay packets (Col. 10, lines 42-49), Acharya does not disclose a group parameter included in state information associated with the data <u>that was multicast to at least one line card</u> indicating at least one destination of the data.

Other claims are also allowable for reasons already of record.

The Examiner states (on page 6 of the office action) that Applicant's arguments do not comply with 37 CFR 1.111(c) because they do not "clearly point out the patentable novelty which he or she thinks the claims present in view of the state of the art disclosed by the references cited or the objections made." Applicant submits that such presentation of "patentable novelty" was made in the previous application. The Examiner also stated that Applicant does not "show how the amendments avoid such references or objections." However, Applicant made no amendments in the previous office action.

In response to Applicant's argument regarding the storage of state information, the Examiner noted that Acharya "teaches the storage of cells in a buffer, which cells inherently comprise state information" and cites Col. 7, line 38 of Acharya: "While the packet is being processed by the IP router to determine its next hop, any successive ATM cells associated with that packet are stored in a buffer particular to that VC." However, "state information associated with the data" is not the same as the data itself. In Acharya, "successive ATM cells associated with that packet" cannot be interpreted as "state information associated with the data" since the successive ATM cells represent the packet itself. For example, Acharya describes "... sending the first cell of the IP packet as an OAM cell and the rest of the packet as data cells" (Col. 9, lines ).

The Examiner also cites Col. 7, lines 37-51 of Acharya as disclosing a line interface card. For example, Acharya describes "… the VP/VC routing table in a Line Interface Card connected to Link 505 is set with the appropriate port number/VP/VCout for that connection (switched mode)." However, Acharya does not disclose or suggest "storing state information associated with the data as a default state at each line card the data was multicast to."

Please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

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